We claim:

1. A process for partially oxidizing acrolein to acrylic acid in the gas phase under heterogeneous catalysis by conducting a starting reaction gas mixture which comprises acrolein, molecular oxygen and at least one inert gas containing at least 20% by volume of molecular nitrogen and contains the molecular oxygen and the acrolein in a molar O_2:C_3H_4O ratio of ≥ 0.5 in one reaction stage over a fixed catalyst bed which is arranged in two spatially successive reaction zones A,B, the temperature of reaction zone A being a temperature in the range from 230 to 320°C and the temperature of reaction zone B likewise being a temperature in the range from 230 to 320°C, whose active composition is at least one multimetal oxide comprising the elements Mo and V, in such a way that reaction zone A extends to an acrolein conversion of from 45 to 85 mol% and, on single pass of the starting reaction gas mixture through the overall fixed catalyst bed, the acrolein conversion is $\geq$ 90 mol% and the selectivity of acrylic acid formation, based on acrolein converted, is $\geq$ 90 mol%, the chronological sequence in which the starting reaction gas mixture flows through the reaction zones corresponding to the alphabetic sequence of the reaction zones, wherein

   a) the hourly space velocity of the acrolein contained in the starting reaction gas mixture on the fixed catalyst bed is $\leq$145 l (STP) of acrolein/l of fixed catalyst bed·h and $\geq$ 70 l (STP) of acrolein/l of fixed catalyst bed·h,

   b) the volume-specific activity of the fixed catalyst bed is either constant or increases at least once in the flow direction of the reaction gas mixture over the fixed catalyst bed, and

   c) the difference $T^{maxA} - T^{maxB}$, formed from the highest temperature T^{maxA} which the reaction gas mixture has within the reaction zone A and the highest temperature T^{maxB} which the reaction gas mixture has within reaction zone B, is $\geq$ 0°C.

2. A process as claimed in claim 1, wherein the difference $T^{maxA} - T^{maxB}$ is $\geq$0°C and $\leq$75°C.

3. A process as claimed in claim 1, wherein the difference $T^{maxA} - T^{maxB}$ is $\geq$3°C and $\leq$60°C.

4. A process as claimed in claim 1, wherein the difference $T^{maxA} - T^{maxB}$ is $\geq$5°C and $\leq$40°C.

5. A process as claimed in any of claims 1 to 4, wherein the hourly space velocity of the acrolein contained in the starting reaction gas mixture on the fixed catalyst bed is ≥70 l (STP) of acrolein/l·h and ≤140 l (STP) of acrolein/l·h.

6. A process as claimed in any of claims 1 to 4, wherein the hourly space velocity of the acrolein contained in the starting reaction gas mixture on the fixed catalyst bed is ≥80 l (STP) of acrolein/l·h and ≤130 l (STP) of acrolein/l·h.

7. A process as claimed in any of claims 1 to 5, wherein the active composition of the fixed catalyst bed is at least one multimetal oxide active composition of the general formula IV

$$Mo_{12}V_aX^1_bX^2_cX^3_dX^4_eX^5_fX^6_gO_n \qquad (IV)$$

where the variables are defined as follows:

X^1 = W, Nb, Ta, Cr and/or Ce,
X^2 = Cu, Ni, Co, Fe, Mn and/or Zn,
X^3 = Sb and/or Bi,
X^4 = one or more alkali metals,
X^5 = one or more alkaline earth metals,
X^6 = Si, Al, Ti and/or Zr,

a = from 1 to 6,
b = from 0.2 to 4,
c = from 0.5 to 18,
d = from 0 to 40,
e = from 0 to 2,
f = from 0 to 4,
g = from 0 to 40, and
n = a number which is determined by the valency and frequency of the elements other than oxygen in IV.

8. A process as claimed in any of claims 1 to 7, wherein the volume-specific activity of the fixed catalyst bed increases at least once in the flow direction of the reaction gas mixture over the fixed catalyst bed.